

Claims:

1                   1 (currently amended).     A test apparatus for visual display of audio  
2     parameters of multiple audio channels ~~of a signal~~, comprising:  
3                   an input to the test apparatus for receiving ~~a signal comprising~~ at least  
4     three audio channels; ~~(---)~~  
5                   wherein one of the audio channels at least temporarily forms a reference  
6     channel for comparison by the test apparatus with at least two other said  
7     channels, each of said at least two other channels at least temporarily forming a  
8     relative channel for comparison of said audio parameters between the relative  
9     channel and the reference channel;  
10                  an amplitude measurement circuit operable to determine a relative  
11     amplitude of the relative channel versus the reference channel;  
12                  a phase comparator operable to determine a relative phase difference of  
13     the relative channel versus the reference channel;  
14                  a visual display responsive to the relative amplitude and the relative  
15     phase difference, wherein the relative amplitude and the relative phase  
16     difference are presented on a same graphic plot on the visual display, in which  
17     relative amplitude and relative phase values are presented by a position  
18     of a point on a two dimensional plot for each said relative channel,  
19     wherein relative amplitude and relative phase are coordinates;  
20                  wherein the graphic plot comprises a polar plot having segments  
21     for the relative channels, in which segments a phase difference between  
22     the respective relative channel and the reference channel is plotted to a  
23     position along a radius of the polar plot, and a relative amplitude of the  
24     relative channel compared to the reference channel, is plotted to a  
25     position laterally spaced from the radius.

2(canceled).

3(canceled).

4(currently amended). The test apparatus of claim 1 -3, wherein the visual display further comprises ~~comprising~~ a graphic display of an absolute parameter for each of a plurality of channels of the signal, wherein the ~~segments separate graphic plots~~ for said at least two relative channels in the polar plot are respectively located to reference the graphic display of the absolute parameter for a corresponding one of the relative audio channels.

5(canceled).

6(currently amended). The test apparatus of claim ~~4 -5~~, further comprising a meter line for plotting signal amplitude of each of ~~a~~ the plurality of the audio channels, the meter lines for said plurality of channels being oriented to radiate from respective ones of the segments along a respective said radius of the polar plot ~~each of the meter lines substantially corresponding to the reference angle in said respective one of the segments.~~

7(currently amended). The test apparatus of claim 1 -4, wherein the visual ~~graphic~~ display contains a marker designating the reference channel, and wherein a selection of the reference channel from among the ~~plural~~ audio channels is changeable ~~by a user selection input~~.

8(original). The test apparatus of claim 1, further comprising a storage device operable to store for a period of time a log representing at least one of values of samples, relative amplitude and phase values, and processed data based on at least one of the sample values and relative amplitude and phase values, and further comprising at least a mode of the visual display wherein the log is plotted.

9(original). The test apparatus of claim 8, wherein said at least one of the relative amplitude and the relative phase values are reduced by at least one of decimation and averaging, for providing alternative plots over different lengths of time.

10(original). The test apparatus of claim 9, wherein at least two amplitude values and at least one phase value are selectively displayable for a length of time of at least one minute.

11(canceled).

12(canceled).

13(canceled).

14(currently amended). **The test apparatus of claim 1, A test apparatus for displaying audio parameters for a plurality of associated channels, comprising:**  
**means for providing- wherein the audio channels carry** time sampled **digital amplitude** values of signals on the plurality of channels;  
**further comprising** a mathematical processing circuit operable to provide from the sampled values at least one of an absolute amplitude value for each of at least two said channels, and relative comparisons of at least one of amplitude and phase for said at least two channels **for a time period equal to at least one time sample, for providing the phase difference and the relative amplitude corresponding to the position of the point on the two dimensional plot.**  
~~;- a display generator having at least one mode wherein the amplitude and phase values of the at least two channels are simultaneously graphically displayed; and,~~

wherein the display generator is configured to display selectively a plot of current data chosen from the group consisting of absolute channel amplitude, relative channel amplitude between identified channel pairs, relative phase between identified channel pairs, relative channel amplitude versus any selected one of the channels, relative channel phase versus any selected one of the channels, and a time plot of previous channel amplitude and phase data.

15(canceled).

16(canceled).

17(canceled).

18(canceled).

19(currently amended). The test apparatus of claim 7 ~~45~~, wherein the graphic display contains a marker designating the reference channel, and wherein selection of the reference channel from among the plural audio channels is changeable by at least one user selection input.

20(currently amended). A method for representing an audio signal having multiple channels associated with a program, on a graphic plot, comprising the steps of:

providing digitized amplitude time samples for a plurality of said channels;

at least temporarily deeming one of the channels as a reference channel for at least two other of the channels as relative channels;

determining a relative amplitude of each said ~~the~~ relative channel versus the reference channel;

determining a relative phase of each said ~~the~~ relative channel versus the reference channel;

changing the channel deemed as the reference channel according to at least one of a user selection and an automatic selection; and,

providing a display having at least one mode wherein ~~at least one of~~ the relative amplitude and relative phase are plotted for current samples ~~together with an absolute amplitude; and,~~  
two of the absolute amplitude and one said relative phase is plotted over a period of time

wherein relative amplitude and relative phase values are presented by a position of a point on a two dimensional plot for each of the relative channels, wherein relative amplitude and relative phase are coordinates;  
wherein the graphic plot comprises a polar plot having segments for the relative channels, in which segments a phase difference between the respective relative channel and the reference channel is plotted to a position along a radius of the polar plot, and a relative amplitude of the relative channel compared to the reference channel, is plotted to a position laterally spaced from the radius.

21(currently amended). The method of claim 20, further comprising ~~+~~ displaying spatial line plots of signal amplitude in a pattern of varying length lines corresponding to signal amplitude for each of a plurality of channels;  
~~displaying the relative amplitude and relative phase of at least one said relative channel in a two dimensional plot in which the relative amplitude and the relative phase are along different axes and the two dimensional plot is associated with the corresponding spatial line plot for the at least one said relative channel.~~

22(currently amended). The method of claim 21, further comprising placing the spatial line plots in a radiating pattern around an origin representing nominal speaker positions for playback of the channels, spacing the spatial lines plots by a radial distance from the origin, and plotting in the radial distance said a polar plot of relative amplitude and relative phase for at least two said relative channels.

23(canceled).

1           24(currently amended). The method of claim ~~20~~ 23, wherein relative  
2 phase between zero and  $180^\circ$  is plotted to a distance from ~~an~~ the origin in the  
3 ~~segments~~ angular sector, and relative amplitude is plotted as circumferential  
4 ~~displacement along an angle above and below an angle of the associated one~~  
5 ~~of the line plots.~~

1           25(original). The method of claim 24, further comprising presenting as  
2 an alarm condition a distinct color representation of points having a relative  
3 phase that is within a predetermined phase difference of  $180^\circ$ .

26(canceled).

1           27(new). The test apparatus of claim 7, wherein the selection of the  
2 reference channel from among the plural audio channels is changeable by at  
3 least one user selection input.

1           28(new). The test apparatus of claim 7, wherein the selection of the  
2 reference channel from among the plural audio channels includes selection of  
3 cycling through different ones of the audio channels.

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